

MEMO

To: Emily Boedecker, Commissioner, DEC

Thru: Matt Chapman, General Counsel, DEC

From: Pete LaFlamme, Director, Watershed Management Division
Chuck Schwer, Director, Waste Management & Prevention Division

Date: July 6, 2017

RE: Recommendations for Landfill Leachate Discharge Guideline Levels for PFOA and PFOS

This memo requests your approval to adopt landfill leachate discharge guideline levels for PFOA and PFOS. In response to the PFOA problem in Bennington County the DEC has requested additional testing for these contaminants throughout the state. Two areas where we have concerns is with leachate from a number of active and closed landfills and wastewater treatment plant sludges. The development of these guideline levels will help the landfill and wastewater treatment plant owners understand what they will need to do to maintain PFOA and PFOS at concentrations below 20 ppt in waters that receive effluent with treated landfill leachates.

In 2016, the DEC added PFOA and PFOS as a hazardous waste but included exemptions from the listing if wastewater, drinking water sludges, landfill leachate or remedial wastes are managed under a plan approved by the Agency. Establishing these guidelines will allow for landfill owners and wastewater treatment facility (WWTF) operators to develop these plans to manage this waste if PFOA and PFOS concentrations in leachate are likely to produce receiving water concentrations ≥ 20 ppt.

Based on research conducted by staff from the Watershed Management Division, we recommend using the following Perfluoroalkyl Substances (PFAS) values in developing landfill leachate disposal plans allowed under the VT Hazardous Waste Management Regulations.

Table 1. PFOA & PFOS Guideline Levels for Accepting Landfill Leachate at permitted WWTF

PFAS analyte:	Column 2:	Column 3:	Column 4:
	Landfill Leachate concentration requiring no restrictions	Landfill Leachate concentration which may require restrictions	Landfill Leachate concentration requiring pretreatment
PFOA	0.120 mg/L	0.120 mg/L to 1.2 mg/L	>1.2 mg/L
PFOS	0.001 mg/L	0.001 mg/L to 0.010 mg/L	>0.010 mg/L

Following these recommendations, the DEC would allow wastewater treatment facilities in Vermont with pretreatment discharge permits to accept leachate with concentrations at or below the levels identified in column 2 above with no restrictions outside current pre-treatment permit provisions.

If leachate concentrations are within column 3 ranges, then the DEC may establish additional conditions as a part of current pretreatment permits which authorize wastewater treatment plants to accept this waste. In this scenario, DEC envisions the development and evaluation of feasible alternatives to reduce influent leachate PFAS concentrations.

For leachate concentrations at or above those noted by column 4, the DEC will require additional pretreatment prior to authorizing continued discharge to a wastewater treatment facility. In this scenario, the influent PFAS concentrations are sufficiently elevated that pre-treatment at the landfill of origin or prior to delivery to the receiving wastewater treatment facility is necessary.

Below is some of the information that was considered in the development of these guideline levels.

Water Quality Guidelines from other States

In the absence of national regulatory standards, research was conducted to determine if other states had developed surface water guidelines. Table 2 below shows surface water quality criteria developed by Minnesota (Source PFOA & PFOS Information Paper 2015)

Table 2. PFOA & PFOS Surface Water Quality Criteria -Minnesota

PFAS analyte:	Aquatic Biota – Chronic	Aquatic Biota – Acute	Human Health – Water & Fish	Human Health – Fish Only
PFOA	1,700,000 ng/L	15,000,000 ng/L	720 ng/L	2,700 ng/L
PFOS	19,000 ng/L	85,000 ng/L	6 ng/L	6 ng/L

Table 2 indicates the Human Health criteria of 6 ng/L-PFOS is the most stringent criteria shown and for PFOA the most stringent criteria would also be the Human Health criteria (water & fish) of 720 ng/L. The CT DEP, has calculated a surface water criteria of 3 ng/L- PFOS and Michigan reported ambient water quality criteria of 12 ng/L-PFOS. This review illustrates Human Health water quality criteria derived for PFOS to range from 3 ng/L – 12 ng/L._

PFOS and PFOA criteria to protect aquatic biota (acute & chronic) are several magnitudes of order higher than the Human Health criteria derived for PFOS and PFOA and as such the Human Health criteria should be used to establish effluent limits protective of water quality criteria, as they are the most conservative criteria in this instance.

PFAS in Landfill Leachate

VTDEC does not currently have data on concentrations of PFAS in leachate found in Vermont landfills. Studies indicate PFAS concentrations in landfill leachate can vary considerably. A Canadian study reported mean value of PFAS concentrations from 28 landfills to be 2,950 ng/L, with the highest concentration reported of 21,300 ng/L (Li et al., 2012). Studies which have evaluated concentrations of individual PFAS compounds within landfill leachate, indicate significantly lower concentrations for the individual concentrations of PFOA

and PFOS. Work by Busch et al. (2010) summarizing the ranges and mean concentrations of individual PFAS compounds in landfill leachate indicated a mean PFOA concentration of 197 ng/L (max = 1,000 ng/L) and a mean PFOS concentration of 97 ng/L (max = 1,500 ng/L). This work indicates a high likelihood that Vermont landfill leachate concentrations will fall within the Column 2 recommended landfill leachate concentrations with no restrictions.

WWTF PFOS and PFOA Removal Rates

Review of literature indicates we should not anticipate much if any removal of PFOA and PFOS during wastewater treatment. Effluent PFOA and PFOS concentrations are often higher than influent concentrations due to PFAS precursors breaking down (to PFOS and PFOA) during treatment.

WWTF Effluent Limit for PFOS and PFOA

To illustrate that the Guidelines for Accepting Landfill Leachate presented in Table 2 are protective of water quality criteria identified in previous section, calculations were completed to determine the receiving water concentrations (RWC) for PFOS and PFOA using the concentrations shown in Column 2 (landfill leachate concentrations with no restrictions).

Table 3 presents the results of these calculations for the five WWTF currently permitted to receive landfill leachate from the NEWSVT, Inc. landfill in Coventry, Vt. The calculations are based on maximum daily permitted volume of leachate for these WWTFs and the Low Median Monthly (LMM) receiving water flow.

The Human Health criteria (consumption of fish and fish and water) for PFOS and PFOA were the most stringent criteria and are applied at annual median flow. As annual median flow data were not available, the low median monthly (LMM) flow values were used for these calculations. LMM is a slightly lower flow than annual median flow, and as such the results shown here will be slightly more conservative and protective. Resulting PFOA and PFOS receiving water concentrations are compared to the most stringent water quality criteria presented in Table 2, which is 720 ng/L- PFOA and 6 ng/L-PFOS.

Table 3. Calculated RWC for PFOS and PFOA at Five WWTFs Using the “No Restrictions” Guideline Concentrations of 120,000 ng/L-PFOA and 1,000 ng/L-PFOS.

WWTF	Daily Max. Leachate (GPD)	Receiving Water	LMM CFS	Calculated RWC from leachate meeting the 'no restrictions' guideline concentrations	
				PFOA 0.12 mg/L	PFOS 0.001 mg/L
Montpelier	23,000	Winooski R.	190	24 ng/L	0.2 ng/L
Burlington North	23,000	Winooski R.	494	9.6 ng/L	0.08 ng/L
Essex Junction	30,000	Winooski R.	470	12 ng/L	0.1 ng/L
Barre	7,000	Stevens Branch	37	24 ng/L	0.2 ng/L
Newport City	15,000	Clyde River	101	22.8 ng/L	0.19 ng/L
Human Health Criteria				720 ng/L	6 ng/L

Table 3 illustrates that the RWC for PFOA and PFOS for all five WWTFs will be well below the most stringent water quality criteria shown for PFOA and PFOS. In fact, all calculated receiving water concentrations are at least an order of magnitude lower than water quality criteria.

Recommendations

Our recommended PFOA and PFOS guideline levels for accepting landfill leachate in WWTF will allow for concentrations up to 120,000 ng/L- PFOA and 1,000 ng/L- PFOS with no management restrictions.

The limit of 120,000 ng/L-PFOA, is unlikely to be problematic. However, the more restrictive 1,000 ng/L-PFOS limit, may be exceeded. If leachate is found to contain concentrations above 1,000 ng/L-PFOS but at or below 10,000 ng/L-PFOS that the DEC would require landfill operators to implement their in-place leachate disposal plan, which would include management strategies that would serve to ensure that receiving water concentrations remained below the recommended human health criteria.

References

- Busch, J., Ahrens, L., Sturm, R., Ebinghaus, R., 2010. Polyfluoroalkyl compounds in landfill leachates. *Environmental Pollution*, 158, 1467-1471.
- Li, B., Danon-Schaffer, M.N., Li, L.Y., Ikonomou, M.G., Grace, J.R., 2012. Occurrence of PFCs and PBDEs in landfill leachates from across Canada, 223, 3365-3372.
- Association of State and Territorial Solid Waste Management Officials, 2015. Perfluorinated chemicals (PFCs): Perfluorooctanoic Acid (PFOA) & Perfluorooctane Sulfonate (PFOS) Information Paper. Remediation and Reuse Focus Group Federal Facilities Research Center.